SCIENCE NEWS

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THE BREATHING RHYTHM

AN explanation of the rhythm of breathing was given by Sir Joseph Barcroft, professor of physiology at the University of Cambridge, at the Harvard Tercentenary Conference.

Three different explanations have been considered for the rhythmic in-and-out of air in respiration. According to one explanation, breathing in starts a message to the brain which checks the inhaling phase and starts the exhaling phase of breathing. This exhaling, in turn, sends a message to the brain that checks the exhaling and starts the inhaling phase.

According to another explanation, there is a continual urge in the central nervous system, which includes the brain, to breath in, but the act of inspiring sets up sensory impulses which check the effort. The lung then passively returns to its unexpanded condition, which takes care of the exhaling. According to this explanation, the brain and central nervous system is the essential seat of breathing and does not merely act as a telephone exchange.

The third view is that breathing is due to rhythmic activity of the central nervous system. The sheep embryo experiments, undertaken with another purpose, unexpectedly furnished support for this view. Sir Joseph and his associates were seeking the solution of another scientific problem, that of how the first movements of the unborn young of mammals start. Do the ordinary movements of legs and arms and other parts of the body arise from generalized mass movements of the whole body, or do the localized movements develop into generalized motions all over the body? The answer was sought by studying the large and slowly growing embryo of the sheep. It was found that the mass movement is built up from localized movements and when built up can be resolved into localized movements which have definite significance and purpose.

A stimulus such as tapping the sheep's snout with a fine glass rod starts a localized movement of the snout and head. Later this stimulus sets up rhythmic movements through the whole body, mass movements which start with the local stimulus to the snout. At a still later stage, these rhythmical mass movements break down and more localized ones appear in response to the stimulus, such as straightening and stretching of tail and limbs. At first these stretching movements are spasmodic, later they become rhythmic. At a still later stage, the lamb fetus is so lively that the rhythmic movements are practically constant and the fetus looks like an ordinary animal breathing naturally. A stimulus at this stage produces more energetic rhythmic movements that give the appearance of an animal out of breath as the result of effort.

The inference is that these rhythmic body movements, which may be elicited by a stimulus to the sensory nerves, show a rhythmic activity of the nervous system which would account for the rhythm of breathing as well as for rhythm in other body activities.

SECONDARY COSMIC RAYS

SPEAKING at the Harvard Tercentenary Celebration, Dr. W. F. G. Swann, of the Bartol Foundation of the Franklin Institute, presented mathematical arguments to the effect that photons are not necessary as primary components of cosmic radiation. Charged particles suffice to explain everything if only one makes certain assumptions as to the way these particles behave. And Dr. Swann has found by means of mathematics just how particles must behave in order that the whole body of cosmic ray facts may be clarified on the particle basis alone.

Little is known of the habits of these fast-flying bits of electricity. Some of the characteristics which Dr. Swann has ascribed to them have been observed by other investigators. Other traits with which he has endowed them are entirely original suggestions and have not, as yet, been brought to the test of independent experimental check.

Some of the things which must be true of the electrified particles if they are to constitute the whole cosmic ray story are the following: (1) There must be two kinds of particles; (2) as they pass through matter, both kinds must lose energy at a rate which increases as the energy of the original particle increases; (3) both kinds of primary particles must produce other high speed particles (called secondaries) by collision with atoms in the air; but the facility with which they do this is different in the two kinds.

The crux of this theory is the way in which the secondary cosmic rays are treated. The existence of secondaries is a well-known fact. But heretofore they have constituted a sort of "mess" which obscured the real cosmic ray facts. According to Dr. Swann's view, however, they are practically the only thing any one observes, and, more than that, they can serve to lead the experimenter back to those real facts which lie behind the scene.

Puzzling to physicists has been the scarcity of very high energy particles when cosmic rays were being watched in the Wilson cloud chamber. For it was known from experiments dealing with the effect of the earth's magnetic field that much of the incoming radiation must have energy greater than ten billion volts. This paradox disappears in Dr. Swann's theory. Compared with the large number of lower energy secondaries, the high-speed primaries are very rare indeed. They may be likened to an "unseen hand" which guides the behavior of the secondaries, and it is through the study of these locally generated particles that the true nature of the ones from outer space can be decided.

HEAT PHOTOGRAPHS

THE discovery of very faint stars closer to the earth and sun than any now known was predicted at the Cambridge meeting of the American Astronomical Society, following a report by Dr. C. W. Hetzler, of the Yerkes Observatory of the University of Chicago, that "heat photographs" of the sky had discovered new stars too

faint and cool to be recorded on ordinary photographic plates.

By using the new rapid infra-red plates cool stars of only a thousand degrees temperature can be photographed with conspicuous success. Heretofore the lowest temperature stars captured by astronomical photographs were at least two thousand degrees.

At present the known star closest to the earth is Alpha Centauri whose light takes four and one third years to reach the earth. An immediate search for small faint stars that may be closer is planned by Dr. Hetzler. The new "heat-seeing" photographs are also expected to result in the discovery of more comets and asteroids, the small fry of the solar system which escape the astronomers' eyes and ordinary photographic observation. Another use of the new observational method will be in a search for stars cooler and perhaps larger than the well-known red, low temperature giants like Antares and Betelgeuse.

The great cloud-like patches of light, so spectacular in astronomical photographs and known as diffuse nebulae, are really dust clouds that mirror the light of near-by stars, according to Drs. Otto Struve, C. T. Elvey and F. E. Roach. Dr. Struve told how he had proved that these nebulae within our own stellar system, the Milky Way, shine by reflected light and consist not of gases but of relatively large aggregates, cosmic dust particles of about one thousand atoms each. These diffuse nebulae reflect the red light near-by of red stars without change, much as sunlight is often reflected beautifully on a fleecy cloud in another part of the sky. If, instead of a red star, there is a blue star near-by, the mirror-like nebula sends out blue light. This is proof that the particles in the nebula are not small like the gas particles in the earth's atmosphere. On the earth the sky is blue because the layers of atmosphere scatter the blue in the sun's light more effectively than the red wavelengths.

Dr. Struve's explanation of one of the puzzles of the sky comes as the first results from McDonald Observatory on Mount Locke, Texas, which is conducted jointly by the University of Texas and the University of Chicago. Dr. Struve is director of both the Yerkes and McDonald Observatories.

The big telescope for McDonald Observatory is not yet ready for use but this investigation was conducted with a sort of "candid camera" of the sky: the Schmidt camera telescope which has a wide field and great light-gathering power that allows short exposures.

NUTRITION AND HEALTH

EATING to live, to live abundantly and healthily, was the central idea of a symposium by members of the faculty of the Harvard Medical School as a part of Harvard's celebration.

Dr. George R. Minot, who presided over the symposium, reminded his hearers that interest in right diet has been on the Harvard campus since the very beginnings of Harvard College. One of the books from the John Harvard library, forming part of the original endowment, was a popular text on nutrition; and a magistrate had to hear the wife of the first professor accused of not feeding the students well enough.

Mention of nutrition probably conjures up visions of "solid food" in the minds of most of us; but the foods we assimilate would do us no good if they were not transported about the body in fluid state, and if wastes were not removed. The wateriness of the human body is proverbial. For this reason, perhaps, the symposium started with a discussion by Dr. J. L. Gamble, of the extracellular body fluids. One fifth of our total body weight consists of fluids outside the living cells. Of this fraction, a fourth consists of the liquid part of the blood, the plasma. The mineral salts in these important body fluids are kept in proper balance by the kidneys, while the carbon dioxide is maintained at the proper level through the action of the respiratory apparatus.

Not being red-blooded is more than a moral or social taunt, from the medical angle; it may mean a very serious lack of health. Several things can cause deficiency of hemoglobin, which gives blood its red color, according to Dr. Clark W. Heath: iron demands for growth, the even more imperious demands by a child on its mother both before birth and during nursing, or the outright loss of blood through a wound. One type of liver extract has been found useful in correction of this deficiency, also minute doses of copper, and possibly the therapeutic use of chlorophyll and bile pigment.

Protein deficiency amounts to a serious diseased condition, Dr. Chester M. Jones explained. Sheer poverty, making it impossible to provide enough meat, eggs and milk, is a tragic cause. Less inexcusable are such derangements as malabsorption, diabetes, nephritis and several other internal diseases.

Defective function in the digestive tract is a frequent cause of failure to digest and absorb food. Dr. William B. Castle explained some of these conditions. In extreme cases, the inner surfaces of the organs may be simply too sore to work, as in pernicious enemia, pellagra and several other ailments. Thus the luckless patient is caught in a vicious downward spiral of malnutrition.

VITAMIN C AT WORK

THE rôle of vitamin C as a bone-maker is familiar, but bone is not the only tissue with which this food element is concerned. Dr. S. Burt Wolbach, speaking at a tercentenary symposium at the Harvard Medical School, told of others: cartilage, certain types of connective tissue and the enamel of the teeth. In general, vitamin C conducts its business not in the cells but between them, for all these tissues are classed as "intercellular."

Dr. Kenneth D. Blackfan emphasized the desirability of careful diagnosis, by means of newly developed chemical tests, for the early recognition of vitamin-deficient states. This is not easy, for the various deficiency diseases are very insidious, and are specially likely to attack children at early ages. But they are so much more easily overcome when caught in early stages that the extra effort is worth while.